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# Wormholes supported by chiral fields

Bronnikov K., Chervon S., Sushkov S.
*Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia*

## Abstract

We consider static, spherically symmetric solutions of general relativity with a non-linear sigma model (NSM) as a source, i.e., a set of scalar fields Φ = (Φ 1,...,Φ n) (so-called chiral fields) parametrizing a target space with a metric h ab(Φ). For NSM with zero potential V (Φ), it is shown that the space-time geometry is the same as with a single scalar field but depends on h ab. If the matrix h ab is positive-definite, we obtain the Fisher metric, originally found for a canonical scalar field with positive kinetic energy; otherwise we obtain metrics corresponding to a phantom scalar field, including singular and nonsingular horizons (of infinite area) and wormholes. In particular, the Schwarzschild metric can correspond to a nontrivial chiral field configuration, which in this case has zero stress-energy. Some explicit examples of chiral field configurations are considered. Some qualitative properties of NSM configurations with nonzero potentials are pointed out. © Pleiades Publishing, Ltd., 2009.

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